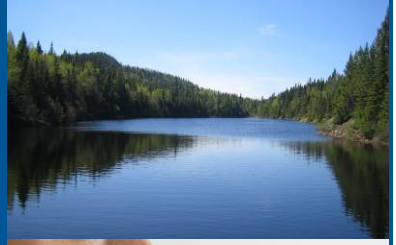







Real-Time Water Quality Report

Leary's Brook Network

Deployment Period
June 17, 2014 to August 7, 2014

Newfoundland Labrador

Government of Newfoundland & Labrador
Department of Environment and Conservation
Water Resources Management Division

Leary's Brook, Newfoundland and Labrador

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General

The Water Resources Management Division (WRMD), in partnership with Environment Canada, maintain a real-time water quality and water quantity monitoring station along Prince Phillip Parkway.

The real-time station allows for assessment and management of the water body. This deployment report discusses water quality related events occurring at the Leary's Brook station.

The purpose of this real-time station is to monitor, process and publish hydrometric (water quantity) and real-time water quality data at the real-time station. Leary's Brook is in the vicinity of the Avalon Mall, a highly developed urban area and an extremely busy roadway.

This report covers the deployment on June 17, 2014 until removal on August 7, 2014.

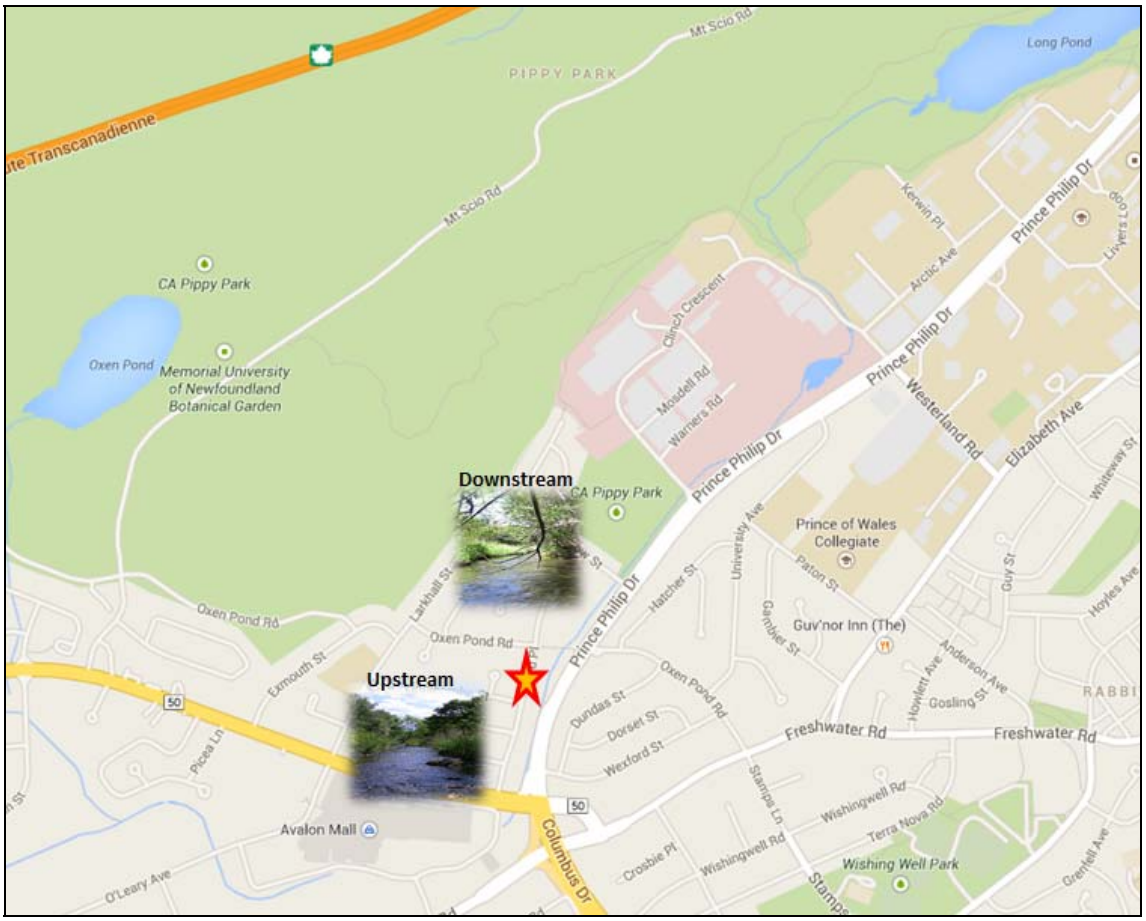

Figure 1: Leary's Brook Real-Time Water Quality and Quantity Station.

Quality Assurance and Quality Control

As part of the Quality Assurance and Quality Control protocol (QA/QC), an assessment of the reliability of data recorded by an instrument is made at the beginning and end of the deployment period. The procedure is based on the approach used by the United States Geological Survey.

At deployment and removal, a QA/QC Sonde is temporarily deployed alongside the Field Sonde. Values for temperature, pH, conductivity, dissolved oxygen and turbidity are compared between the two instruments**.** Based on the degree of difference between the parameters on the Field Sonde and QA/QC Sonde at deployment and at removal, a qualitative statement is made on the data quality (Table 1).

Table 1: Instrument Performance Ranking classifications for deployment and removal

	Rank				
Parameter	**Excellent**	**Good**	**Fair**	**Marginal**	**Poor**
Temperature (°C)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	<+/-1
pH (unit)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Sp. Conductance (µS/cm)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Sp. Conductance > 35 µS/cm (%)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Dissolved Oxygen (mg/L) (% Sat)	<=+/-0.3	>+/-0.3 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Turbidity <40 NTU (NTU)	<=+/-2	>+/-2 to 5	>+/-5 to 8	>+/-8 to 10	>+/-10
Turbidity > 40 NTU (%)	<=+/-5	>+/-5 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20

It should be noted that the temperature sensor on any sonde is the most important. All other parameters can be divided into subgroups of: temperature dependant, temperature compensated and temperature independent. Due to the temperature sensor's location on the sonde, the entire sonde must be at a constant temperature before the temperature sensor will stabilize. The values may take some time to climb to the appropriate reading; if a reading is taken too soon it may not accurately portray the water body.

Deployment and removal instrument performance rankings for **Leary's Brook** for the period of June 17, 2014 through to August 7, 2014 are summarized in Table 2.

Table 2: Instrument performance rankings for Leary's Brook

Station	**Date**	**Action**	**Comparison Ranking**				
			Temperature	**pH**	**Conductivity**	**Dissolved Oxygen**	**Turbidity**
Leary's Brook	**June 17 2014**	**Deployment**	Marginal	Excellent	Excellent	Poor	Excellent
	Aug 7 2014	**Removal**	Excellent	Good	Excellent	Excellent	Poor

At the Leary's Brook station at the point of deployment, the water temperature ranked as 'Marginal' it is likely that the QA sonde temperature probe was not stabilized at the time the reading was taken. This is likely also the reason for the ranking of 'Poor' for dissolved oxygen, as this probe requires the water temperature data in order to provide an accurate dissolved oxygen concentration (mg/L). All other parameter data ranked as 'Excellent' for deployment of the field sonde.

At removal, the temperature, specific conductivity and dissolved oxygen ranked 'Excellent'. The pH data ranked as 'Good'. Turbidity data ranked as 'Poor' at removal. The 'Poor' ranking may be a result of the buildup of sediment and sand that occurs in the protective cage around the instrument. Occasionally during removal, the instrument can be buried in sediment and gravel that flushes through the brook.

Deployment Notes

Please note that the stage data in this report is raw data. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

Precipitation data from the deployment period was retrieved from the Environment Canada's weather station at St. John's International Airport.

Leary's Brook

Water Temperature

Water temperature ranged from 9.76°C to 22.90°C during this deployment period (Figure 2).

Water temperature at this brook displays a typical variation in pattern over the deployment period. Water temperature is influenced by air temperature. As the seasonal air temperatures stabilize the water temperatures do the same.

There are several evident stage increases during the deployment period (highlighted in red circles) whereby the water temperature decreases at each event and returns to the general diurnal pattern after.

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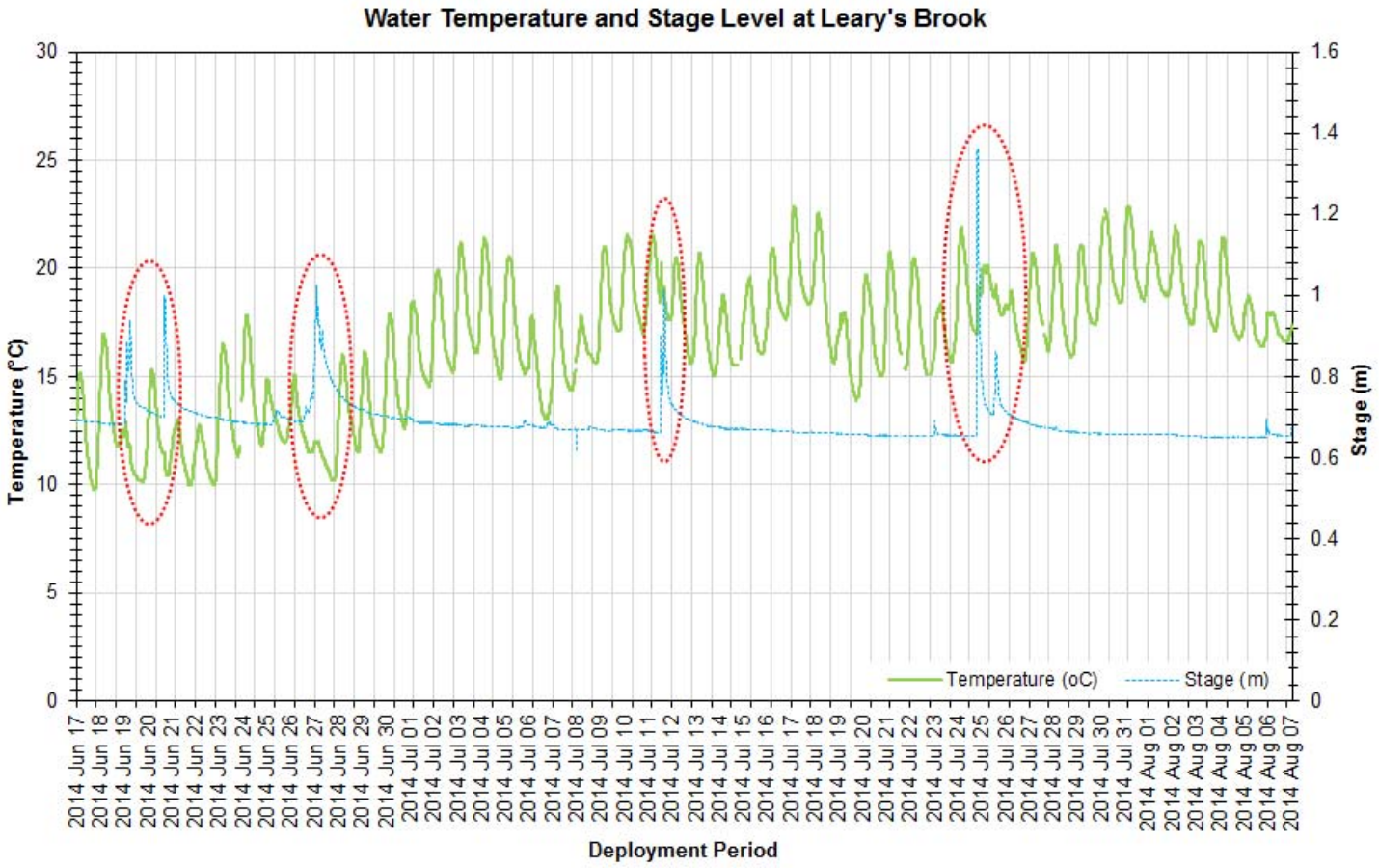

Figure 2: Water temperature (°C) and Stage (m) values at Leary's Brook

pH

Throughout this deployment period pH values ranged between 6.45 pH units and 7.26 pH units (Figure 3).

At the beginning of the deployment period the pH levels remained within the CCME guidelines for the protection of aquatic life. The pH levels dipped below the guideline for several days on July 19th to 20th and again on July 23rd to July 24th.

There was a slight increase in pH levels during the stage event on July 25th however the other stage increases did not influence the pH levels significantly.

There was one obvious event in pH (circled in red) where the levels increase for a short period of time, however this cannot be explained at this time.

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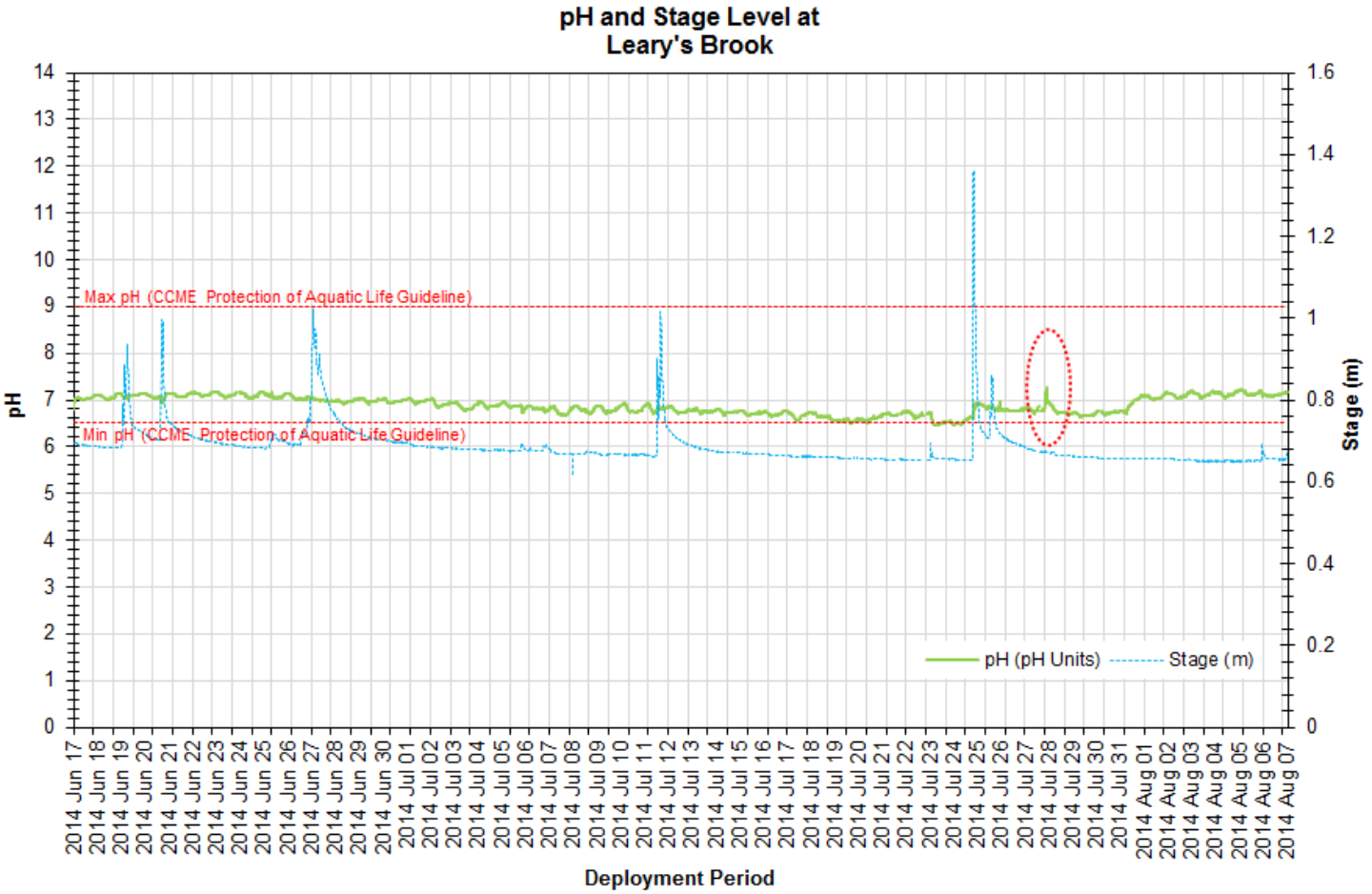

Figure 3: pH (pH units) and Stage (m) values at Leary's Brook Station

Specific Conductivity

The conductivity levels were within 197.8 µS/cm and 2247.9 µS/cm during this deployment period. TDS ranged from 0.1266 g/L to 1.4400 g/L.

The natural relationship between conductivity and increased stage level is evident on Figure 4. As the stage increases, flushing the suspended solids through the brook, the conductivity levels decrease.

There is an increase in conductivity (circled in red) that corresponds with an increase in pH for the same time frame. It is unclear what may have influenced the data at this time.

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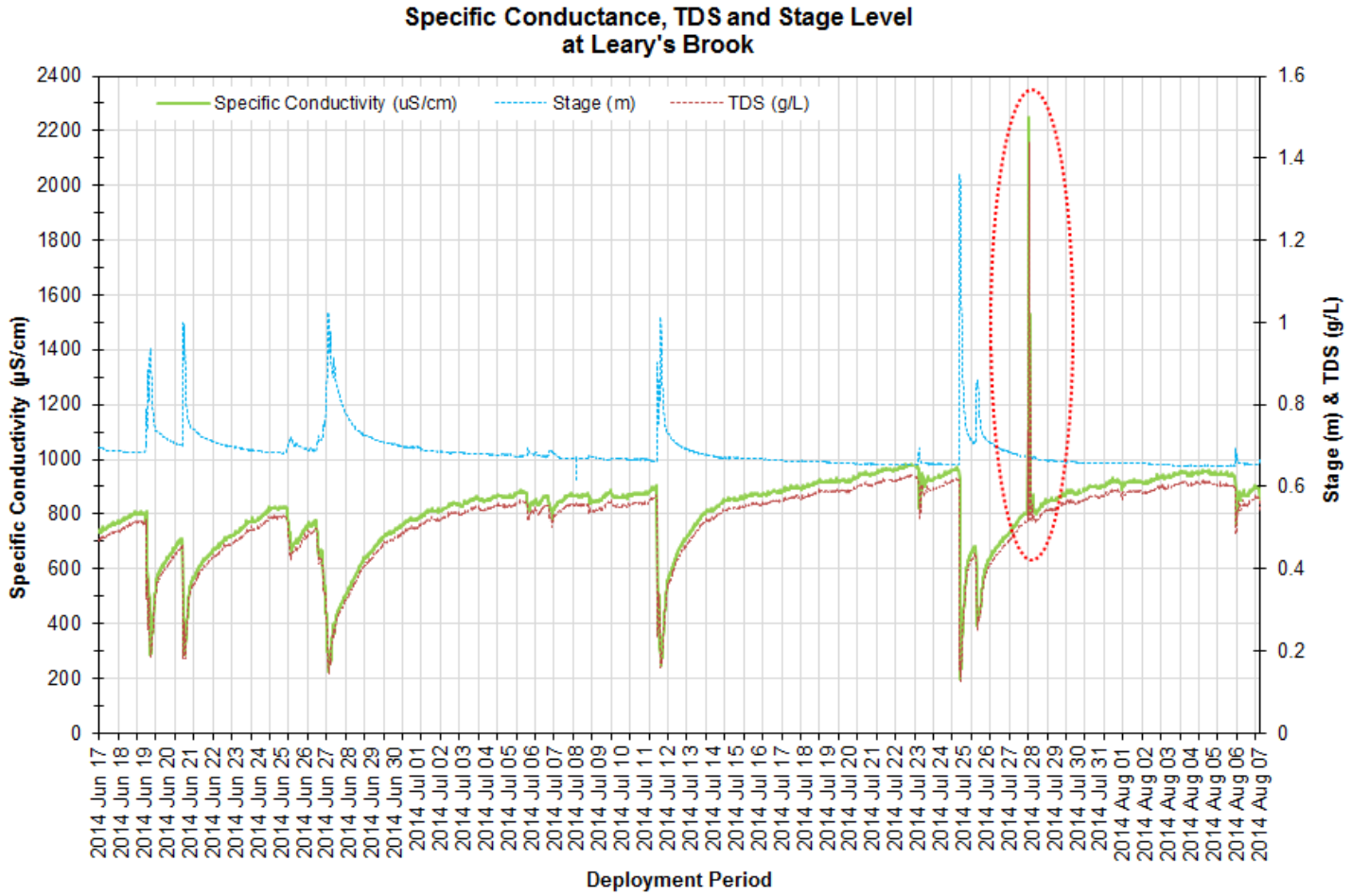

Figure 4: Specific conductivity (µS/cm), TDS (g/L)) and stage (m) values at Leary's Brook Station

Dissolved Oxygen

The instrument measures dissolved oxygen (mg/L) directly then calculates percent saturation (% Sat.).

The Dissolved Oxygen % Sat levels within this deployment period were within 101.0% Sat and 81.4% Sat. Dissolved Oxygen (mg/L) measured 7.05 mg/L to 10.57 mg/L.

Naturally in the warmer months the Dissolved Oxygen present in the water will decrease. While the Dissolved Oxygen mg/L values were above the minimum Dissolved Oxygen CCME guideline for other life stages throughout this deployment period (Figure 5) they dipped below the CCME guidelines for the protection of early life stages.

There is a flattening of the dissolved oxygen data from July 25th through to July 28th, 2014 (highlighted in red) this event is within the same timeframe as events on the pH and conductivity graphs.

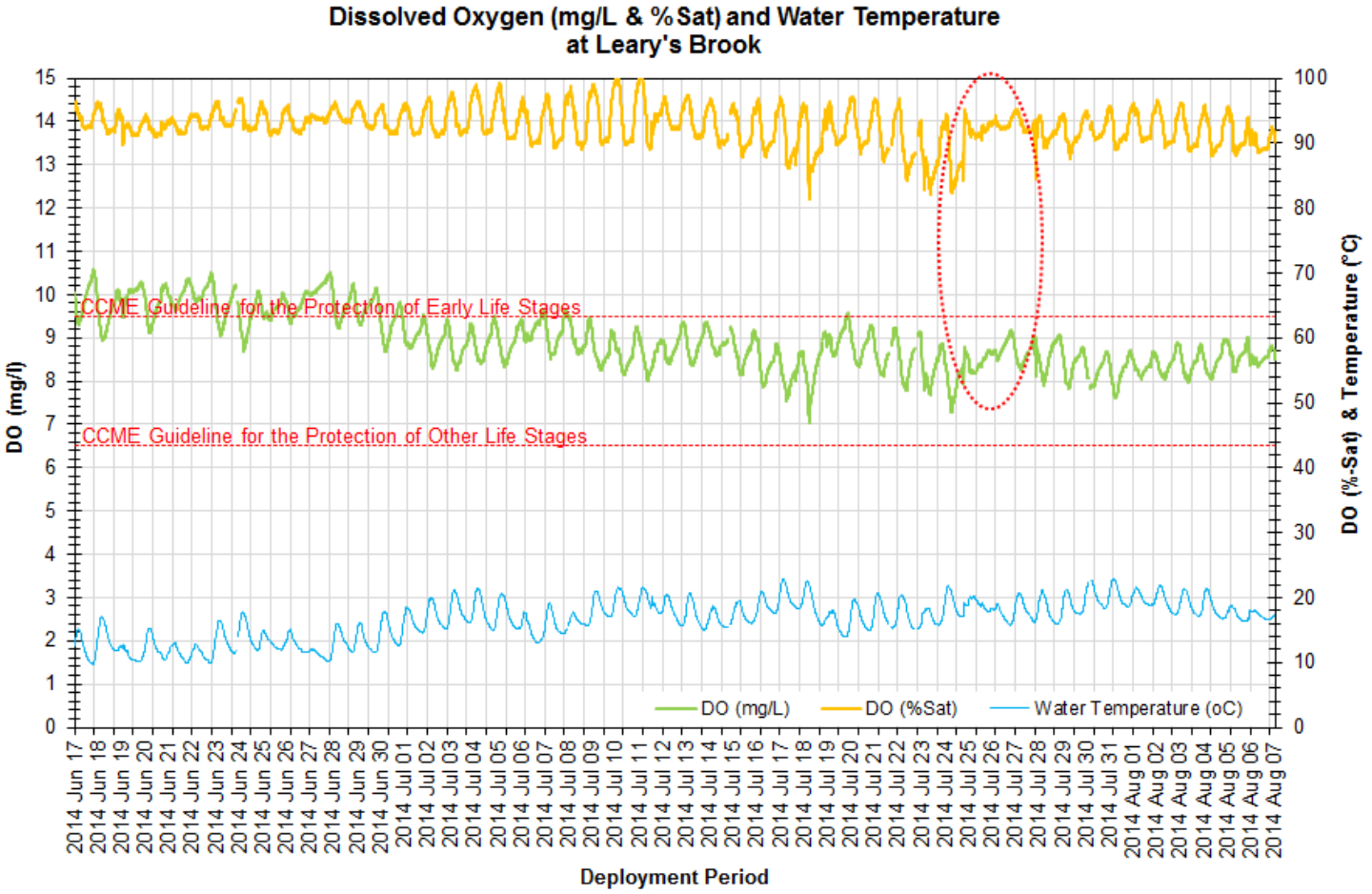

Figure 5: Dissolved oxygen (mg/L & % sat) and water temperature (°C) values at Leary's Brook Station

Turbidity

The turbidity readings during this deployment ranged within 0.0 NTU to 2457.9 NTU (Figure 6).

It is very likely that the turbidity events evident on the graph in Figure 6 correspond with precipitation events. This particular brook is influenced by the surrounding urban environment and is very flashy during rainfall events. During rainfall and then the subsequent runoff comes an increase in sediment and material flowing into the brook and this is what is captured by the turbidity sensor.

This instrument can be impacted by the increased sediment in the brook, sediment packs around the sensors and sometimes can cause irregular readings. The turbidity data was removed from June 22nd to June 25th, 2014 and from July 16th to July 25th, 2014 as it was not representing the waterway at that time.

The highest turbidity noted during this deployment period (circled in red) was on July 28th, 2014 this event also coincides with an event in dissolved oxygen concentration and increases in conductivity and pH for the same timeframe.

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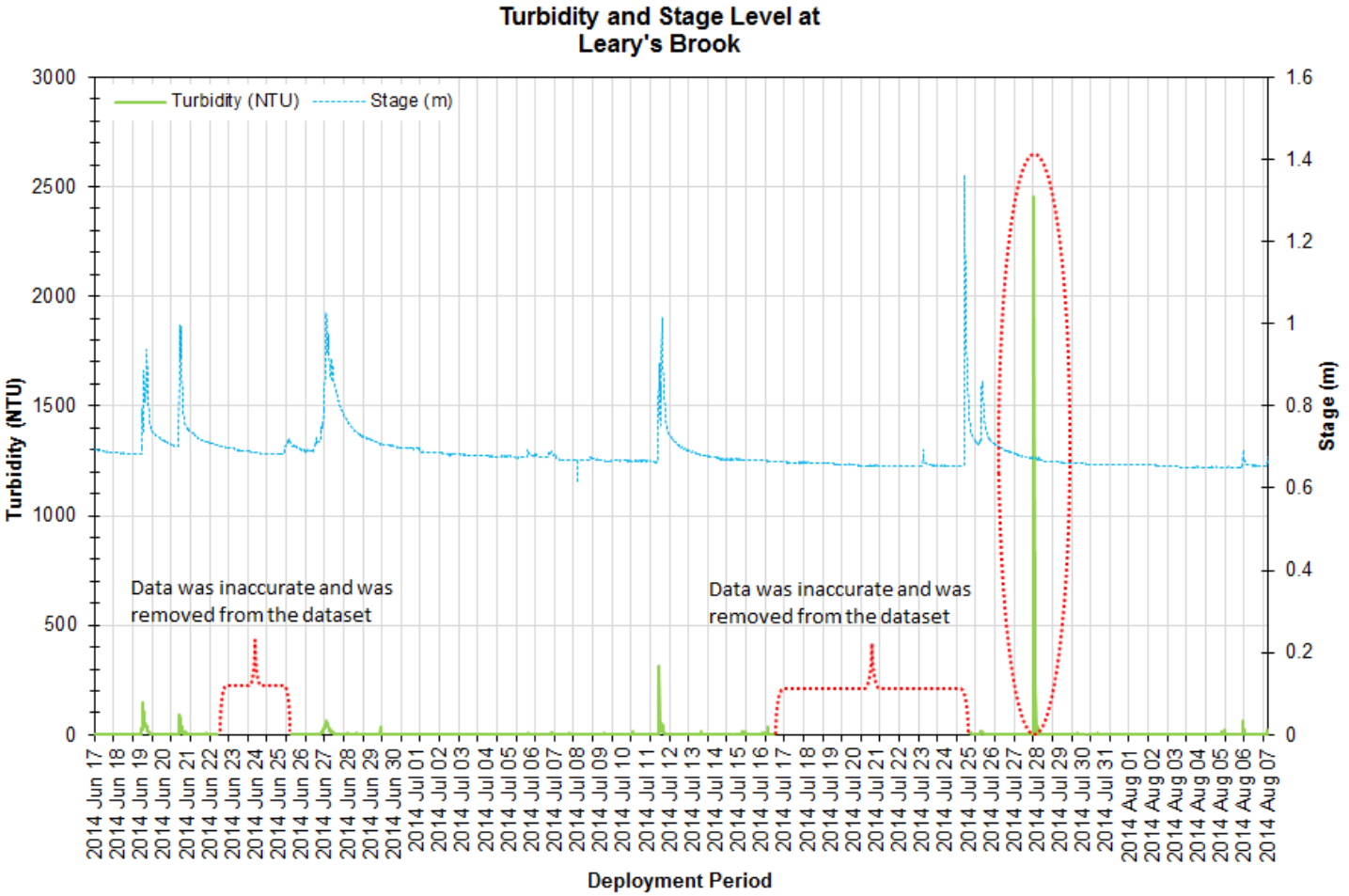

Figure 6: Turbidity (NTU) and Stage (m) values at Leary's Brook Station

Stage and Total Precipitation

The below graph includes precipitation data from St. John's International Airport weather station and the stage data recorded at Leary's Brook Station. Please note that the stage data in this report is raw data and it has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

Stage is important to display as it provides an estimation of water level at the station and can explain some of the events that are occurring with other parameters (i.e. Specific Conductivity, DO, turbidity). It is not unusual to see stage vary throughout the deployment period (Figure 7). Stage is directly influenced by rainfall and subsequent runoff from the surrounding environment.

The highest precipitation was recorded on July 25th 2014 at 37mm total for that day.

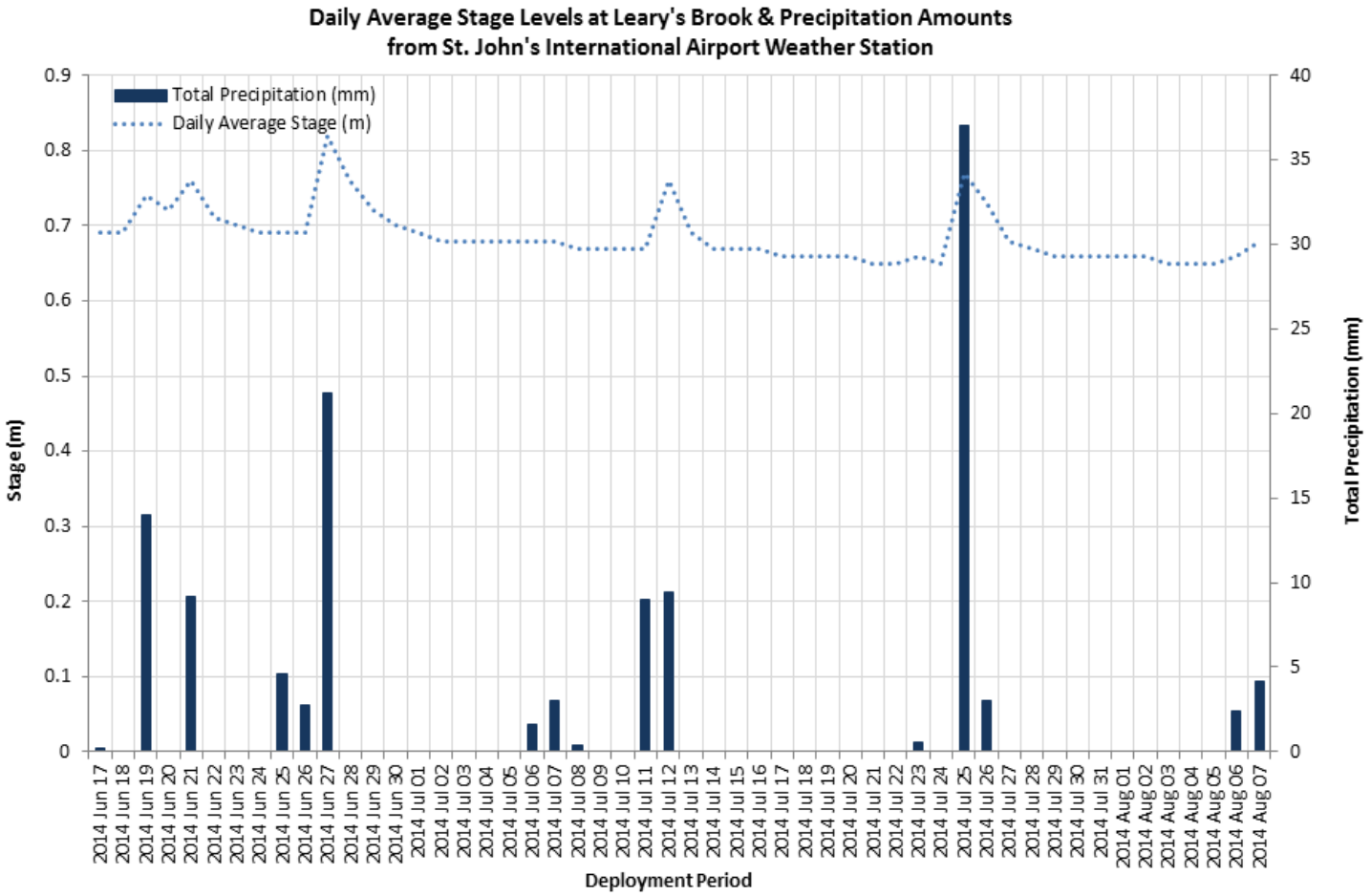

Figure 7: Stage values (m) from Leary's Brook Station and daily total precipitation values (mm) from St. John's International Airport Weather Station.

Conclusions

Generally in natural environments, climate and weather conditions contribute in large part to the variation in water quality parameters. During this deployment it was evident that many of the changes in the parameter data displayed on the graphs, was related to the intermittent precipitation events and small climatic changes of the seasons (i.e. temperature decreases).

Precipitation events during the deployment period led to related fluctuations in stage, which thus influenced the values of turbidity, pH, specific conductance, and TDS. During the warmer months there were correspondingly warmer water temperatures, which in turn slightly decreased the amount of dissolved oxygen in the water.

During this deployment period the median water temperature at the Leary's Brook station was 17°C. Water temperature will continue to fluctuate and be influenced by the surrounding summer air temperatures.

The Specific Conductivity median at Leary's Brook was 850.0µS/cm.

The median pH value for Leary's Brook Station was 6.87 (pH units). The pH level for the most part is steady at this station.

Dissolved Oxygen at Leary's Brook had a median of 92.6 % Sat during the deployment period. The small dips in DO (mg/L and % Sat) correspond with water temperatures. The larger dips in DO (mg/L and %Sat) at Leary's Brook correspond with large rainfall events.

The majority of turbidity spikes were correlated with increases in precipitation and coinciding stage increases. The turbidity median value at Leary's Brook during deployment was 0.0 NTU.

There was no explanation for the spike in levels for pH, conductivity and turbidity and the unusual data recorded for dissolved oxygen (mg/L and % Sat) that occurred on the morning off July 28th, 2014.